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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Application Number: 10/605,645
Filing Date: October 15, 2003
Appellant(s): SARANATHAN ET AL.

Timothy J. Ziolkowski
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9 December 2008 appealing from the Office action mailed 16 May 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US 2001/0004211	Ookawa	6-2001
US 6380740	Laub	4-2002
US 5873825	Misretta	2-1999

Jezzard, Peter "Physical Basis of Spatial Distortions in Magnetic Resonance Images." in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435

Stephen J. Riederer, "Current Technical Development in Magnetic Resonance Imaging," IEEE Engineering in Medicine and Biology Magazine, September/October 2000.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1,2, 4 through 6, 9, 10 and 20 - 25 are rejected under 35 U.S.C. 102(b) as being unpatentable over Pub. No. US 2001/0004211 to Ookawa (Ookawa) in view of US Pat. No. 6,380740 to Laub (Laub) further in view of Jezzard, Peter “Physical Basis of Spatial Distortions in Magnetic Resonance Images.” in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press,

2000), pp. 425-435; hereinafter Jezzard (Jezzard).

<u>In Reference to Claim 1</u>

Ookawa teaches:

A method of MR imaging comprising the steps of:

partitioning k-space into a number of partitions (see fig. 6 and section [0027] on page 2),

wherein the partitions incrementally increase in distance from a center of k-space (see fig. 6 and section [0031] on page 2);

Ookawa also explicitly teaches:

applying magnetic preparation pulses (flip pulse) and acquiring data such that a rate by which the magnetic preparation pulses are applied is a function of the incremental distance a partition of MR data is from the center of k-space (see fig. 5 and section [0031] on page 2). However Ookawa fails to explicitly teach "applying magnetic preparation pulses and acquiring data in an *elliptic centric acquisition order*, such that a rate by which the magnetic preparation pulses are applied is a function of the incremental distance a partition of MR data is from the center of k-space." Ookawa does disclose a 3D sampling and acquisition scheme that can be used for MR Angiography (MRA) and involves interrogating a "plurality of (annular) regions" (see fig. 6 and sections [0027] and [0031] on page 2) demarcated in "elliptic centric" fashion.

Laub discloses using 3D fast gradient pulse sequences in dynamic MRA studies for improving "spatial/temporal resolution " which employ elliptic centric acquisition order

(see abstract, column 3, lines 23-64 and figures 6-9).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have included the elliptic centric data acquisition order of Laub in the method of Ookawa to further improve image spatial and temporal resolution as explicitly taught Laub.

However, Ookawa in view of Laub does not disclose "and playing out a dummy acquisition following each of the magnetic preparation pulses. "

Jezzard, in the same field of endeavor, teaches the application of a delay which is determined by applying dummy acquisitions or scans in order to allow spins to have reached a steady state when the image signal is detected and to curtail non-frequency-encoded (e.g. phase- and/or slice-encode) derived artifact or noise ; (see Jezzard, p. 434, section 6.2 "Non-Steady State Effects", and equations 11, 12 and 13). Further, it has been discussed that it is well known in the art to apply dummy acquisitions prior to actual data acquisition and after magnetization preparation . (see items 4 and 5 in Remarks supra)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have included the dummy acquisitions or scans of Jezzard in the method of Ookawa in view of Laub to allow steady state spin conditions to be achieved and reduce the corresponding image noise effects as explicitly taught Jezzard.

In Reference to Claim 2

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 1. In addition Ookawa further teaches:

The method of claim 1 wherein the magnetic preparation pulses are saturation pulses (e.g. pre-saturation pulse in Ookawa; see page 2, section [0021]), and further comprising the step of decreasing the rate by which the saturation pulses are applied as the distance a partition of MR data is from the center of k-space increases (see fig. 6 and sections [0027] – [0031] on page 2, and sections [0032] and [0033] page 3).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 2 limitations.

In Reference to Claim 4

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 1 as discussed above. Ookawa further teaches "the step of playing out the magnetic preparation pulses every NiTR for an ith partition, wherein N1<N2<NM-1<NM, and M corresponds to the number of partitions" (see abstract, figs. 5 and 6, sections [0027] – [0031] on page 2, and sections [0032] – [0036] on page 3).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 4 limitations.

In Reference to Claim 5

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations claim 4. Ookawa further teaches that the number of (i.e. k-space) partitions (region divisions) may be "changed in various patterns" (see sections [0033]

–[0036] on page 3) and “can be variously modified” to adjust the image contrast and the output of artifacts.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have selected three partitions as taught to optimally vary the number of partitions in order to “adjust the image contrast and the output of artifacts” as explicitly taught in Ookawa.

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 5 limitations.

<u>In Reference to Claim 6</u>

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 5. Ookawa further teaches that the rate or “frequency” at which (magnetization or) pre- pulses are played out may also be “changed in various patterns” (see sections [0034] –[0036] on page 3). Ookawa further teaches, “ various patterns can be adopted for the division method of regions using different frequencies in the k-space, i.e., for region boundaries. A plurality of region division pattern data in the k-space may be prepared and may be selectively used in accordance with an instruction from the operator. These frequency patterns and region division patterns can be arbitrarily combined and used to arbitrarily adjust the image contrast and the output of artifacts.” (see section [0035] on page 3)

It would have been obvious to one of ordinary skill in the art at the time of the invention to have selected the “step of playing out fat saturation pulses every five TRs for the first partition, every 15 TRs for the second partition, and every 40 TRs for the

third partition" in order to "adjust the image contrast and the output of artifacts" for the particular application at hand as taught by Ookawa.

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 6 limitations.

<u>In Reference to Claim 9</u>

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 1. Additionally, Ookawa has been shown to teach the step of optimizing fat saturation based on the particular application at hand (see section [0035] on page 3). However, Ookawa fails to teach "the step of maximizing fat saturation while minimizing differential weighting of k-space while acquiring the central of region k-space."

It is well known in the art that dummy acquisitions as mentioned earlier may be used to address the issue of compensating for "differential weighting of k-space while acquiring the central of region k-space" that results from non-steady state sampling effects when a centric phase encoding technique is used. It is in order to maintain steady state and minimize noise effects, that these delays are employed for peripheral-central region-based sampling .

It would have been obvious to one of ordinary skill in the art that the step of "minimizing differential weighting of k-space while acquiring the central of region k-space" would apply for sampling schemes which employed elliptic centric order acquisitions and which incorporated dummy acquisitions when transitioning between a

peripheral region to the central region.

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 9 limitations.

In Reference to Claim 10

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 1. In addition Ookawa further teaches: The method of claim 1 wherein the data acquisition in k-space includes a radial acquisition in k-space (see figure 6). See also Laub column 3, lines 48-64.

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 10 limitations.

In Reference to Claim 20

Ookawa in view of Laub teaches:

A computer readable storage medium having stored thereon a set of instructions that when executed by a computer (see Ookawa figure 1) causes the computer to:

- partition k-space data into a number of partitions (see Ookawa fig. 6 and section [0027] on page 2), each a given distance from a center of k-space (see Ookawa fig. 6 and section [0031] on page 2);

- play out a magnetic preparation pulse at a different rate for each partition, the rate being dependent on the given distance a partition is from the center of k-space (see Ookawa fig. 5 and section [0031] on page 2);

- acquire MR data in an elliptical centric order (see Laub abstract, column 3, lines

23-64 and figures 6-9);

However, Ookawa in view of Laub does disclose: A computer readable storage medium having stored thereon a set of instructions that when executed by a computer causes the computer to:

- play out at least one dummy acquisition during MR data acquisition following each of the magnetic preparation pulses.

The basis for applying dummy acquisitions after magnetic preparation pulses in order to effect delays and boost overall image quality has been discussed (see claim 1 rejection).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 20 limitations.

In Reference to Claim 21

Ookawa in view of Laub further in view of Jezzard has been shown to teach all limitations of claim 20. In addition Ookawa further teaches: ... wherein each partition is centered about a center of k-space (see figure 6) such that magnetic preparation occurs more frequently during MR data acquisition of a partition closer to the center of k-space than that of a partition farther from the center of k-space (see figures 5 and 6, and section [0033] on page 3).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 21 limitations.

In Reference to Claim 22

Ookawa in view of Laub further in view of Jezzard has been shown to teach all the limitations of claim 21. In addition, Ookawa further discloses "wherein a rate of magnetic preparation pulses is non-zero for each partition" (see sections [0033] and [0034] on page 3).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 22 limitations.

In Reference to Claim 23

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 20. Laub further teaches the step "wherein the set of instructions further causes the computer to define boundaries of each partition and determine the number of partitions based on a k-space extent of a 3D image FOV." Laub teaches the partitioning of k-space into 3D annular partitions so as improve spatial and or time resolution (see Laub figures 3,4 and 6, and column 3, lines 23-63). Laub further teaches that the selection of the number and relative size of the segments may be varied and customized to the application at hand so as to enable sufficient spatial and temporal resolution for tracking dynamic (fast) events within the body (see Laub, column 7, lines 13-21).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 23 limitations.

In Reference to Claim 24

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 23. Laub further teaches that the 3D annular segments of his invention are bounded consecutively (respectively or one after the other) so that a central region is encompassed within a number of peripheral regions and that this approach improves spatial resolution over prior methods (see Laub figures 3,4 and 6, column 3, lines 28-63, column 7, lines 38-46). Also, the MR data is acquired using centric phase encoding. It is well known in the art that centric phase encode methods such as described by Laub employ techniques which minimize k-space discontinuities between adjacent k-space views.

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 24 limitations.

In Reference to Claim 25

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 20. In addition Ookawa further teaches: T he "computer readable storage medium of claim 20 wherein the rate for each partition is non-linearly dependent on the given distance a partition is from the center of k-space (see figure 5 and sections [0033] -[0034] on page 3).

The contributions of Laub and Jezzard to Ookawa with regard to "wherein the set of instructions further causes the computer to play out a dummy acquisition following

each magnetic preparation pulse and prior to data acquisition in each partition have been discussed above (see claim 1 and 20 rejections).

Therefore, Ookawa in view of Laub further in view of Jezzard teaches all claim 25 limitations.

2. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pub. No. US 2001/0004211 A1 to Ookawa (Ookawa) in view of US Pat. No. 6,380740 to Laub (Laub) further in view of Jezzard, Peter "Physical Basis of Spatial Distortions in Magnetic Resonance Images." in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435; hereinafter Jezzard (Jezzard), and further in view of Stephen J. Riederer (Riederer), "Current Technical Development in Magnetic Resonance Imaging", IEEE Engineering in Medicine and Biology Magazine, September/October 2000.

In Reference to Claim 7

Claim 7 states: "The method of claim 1 further comprising the step of determining the number of partitions based on an FOV from which MR data is to be acquired."

Ookawa in view of Laub further in view of Jezzard has been shown to teach all of the limitations of claim 1. However, Ookawa in view of Laub further in view of Jezzard does not explicitly teach "the step of determining the number of partitions based on an FOV from which MR data is to be acquired."

Riederer addresses a number of key technical developments in MRI for the year

2000. Among these is the significance of FOV selection in k-space for determining the speed of image acquisition (i.e. smaller FOV correlates to faster image acquisition and vice versa) and spacing between k-space views or lines or strips (e.g. k-space discontinuity between adjacent views; see middle column on page 36 and figs. 1(a) – 1(c)) for fast MRI scan methods where grabbing data as quickly as possible is essential. The number of elliptic centric (radially increasing) regions chosen in k-space vary in direct proportion to the FOV.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have included “the step of determining the number of partitions based on an FOV from which MR data is to be acquired” of Riederer in the method of Ookawa in view of Laub further in view of Jezzard in order to obtain “greater image acquisition speed.”

<u>In Reference to Claim 8</u>

Ookawa in view of Laub further in view of Jezzard and in view of Laub further in view of Jezzard and further in view of Riederer has been shown to teach all of the limitations of claim 7. Additionally, Riederer has also been shown to present a rationale for optimizing the spacing between consecutive k-space views according to claim 8 (see the “New Acquisition Strategies” section on pages 35 and 36 and figs. 1(a) – 1(c)).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have included “the step of determining the number of partitions to minimize k-space discontinuity between adjacent k-space views” of Riederer in the

method of Ookawa in order to optimize the FOV requirements for “greater image acquisition speed” with the k-space view spacing so as to reduce artifacts and improve image quality in the reconstructed image as taught by Riederer.

3. Claims 11-14,16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 5,873,825 to Misretta (Misretta) in view of Pub. No. US 2001/0004211 to Ookawa (Ookawa) further in view of Jezzard, Peter “Physical Basis of Spatial Distortions in Magnetic Resonance Images.” in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435; hereinafter Jezzard (Jezzard)..

In Reference to Claim 11

Claim 11 States: An MRI apparatus comprising (see figure 1) : a magnetic resonance imaging (MRI) system having a gradient coils positioned about a bore of a impress a polarizing magnetic field (see figure 1, reference marks 127, 139 and 141) and an RF transceiver system (figure 1, reference mark 150) and an RF switch (figure 1, reference mark 154) controlled by a pulse module (figure 1, reference mark 121) to transmit RF signals to an RF coil assembly (figure 1, reference mark 152) to acquire MR images; and a computer (figure 1, reference mark 107) programmed to: partition k-space into a number of partitions, each having an increased distance from a center of k-space (see column 4, lines 40-67, column 5, lines 1-2 and columns 6, lines 42-67 through column 8, line 1); apply magnetic preparation pulses at a first rate during data

acquisition for a first radial partition; and apply magnetic preparation pulses at a second rate, different from the first rate, during data acquisition for a second partition.

Therefore, Misretta teaches all of the apparatus elements of claim 11 (see figure 1) with the exceptions of the steps to "play out a dummy acquisition following each of the magnetic preparation

pulses" and "apply magnetic preparation pulses at a first rate during data acquisition for a first radial partition; and apply magnetic preparation pulses at a second rate, different from the first rate, during data acquisition for a second partition."

Ookawa has been shown to teach the application of magnetic preparation pulses in k-space according to region in which you are located (see section [0033] on page 3).

Also, Jezzard has been shown to teach playing out a dummy acquisition following each of the magnetic preparation pulses (see rejection for claim 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have included the step of applying "magnetic preparation pulses at a first rate during data acquisition for a first radial partition; and apply magnetic preparation pulses at a second rate, different from the first rate, during data acquisition for a second partition" of Ookawa to the MRI apparatus of Misretta in order to produce an MRI system that allows for the combination of variable rate magnetization preparation pulse sampling of multiple regions in order to control image contrast and output of artifacts as taught by Ookawa. It would be further obvious to include the step of applying dummy acquisitions after each magnetization preparation pulse of Jezzard

in the method of Misretta in view of Ookawa in order to allow spins to have reached a steady state when the image signal is detected and to reduce image noise as taught by Jezzard (see claim 1 rejection).

<u>In Reference to Claim 12</u>

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations of claim 12 with respect to claim 11. In addition, Ookawa further teaches the step "wherein the first rate and second rate are a function of partition distance from the center of k-space" (see section [0033] on page 3).

Therefore, Misretta in view of Ookawa further in view of Jezzard teaches all claim 12 limitations.

<u>In Reference to Claim 13</u>

Misretta in view of Ookawa has been shown to teach all of the limitations claim 11. In addition, Ookawa further teaches the step "wherein the first rate is greater than the second rate if the first radial partition is closer to the center of k-space than the second radial partition" (see section [0033] on page 3).

Therefore, Misretta in view of Ookawa further in view of Jezzard teaches all claim 13 limitations.

<u>In Reference to Claim 14</u>

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations claim 13. In addition, Ookawa further teaches the step "wherein the saturation pulse is a magnetization preparation pulse" (see section [0022] on page 2).

Therefore, Misretta in view of Ookawa further in view of Jezzard teaches all claim 14 limitations.

In Reference to Claim 16

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations of claim 11. In addition, Ookawa further teaches the step of "wherein the magnetic preparation pulses include at least one of a fat saturation pulse, an IR pulse, and a spatial saturation RF pulse" (see section [0021] on page 2).

Therefore, Misretta in view of Ookawa further in view of Jezzard teaches all claim 16 limitations.

In Reference to Claim 18

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations of claim 11. In addition, Misretta further teaches using a computer program within an MRI system to carry out "elliptical centric phase order acquisition of MR data" from different regions or tissues within the body; particularly those associated with the cardiovascular system (see column 1, lines 14-23, column 3, lines 60-67 and column 6, lines 42-50).

Therefore, Misretta in view of Ookawa further in view of Jezzard teaches all limitations of claim 18.

4. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat.

No. 5,873,825 to Misretta (Misretta) in view of Pub. No. US 2001/0004211 to Ookawa (Ookawa) further in view of Jezzard, Peter "Physical Basis of Spatial Distortions in Magnetic Resonance Images." in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435; hereinafter Jezzard (Jezzard), and further in view of Stephen J. Riederer (Riederer), "Current Technical Development in Magnetic Resonance Imaging", IEEE Engineering in Medicine and Biology Magazine, September/October 2000.

In Reference to Claim 17

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations of claim 11. However, Misretta in view of Ookawa further in view of Jezzard fails to explicitly teach the step "wherein the computer is further programmed to determine dimensions of an FOV and, from the dimensions, determine a number of radial partitions such that discontinuities between adjacent k-space locations are reduced."

Riederer teaches utilizing fast scan/imaging techniques that employ FOV calculation and compensation methods, which in turn have a direct bearing on k-space discontinuities (see figs. 1a – 1c) and middle paragraph on page 36.

Therefore, it would also have been obvious to one of ordinary skill in the art at the time of the invention to have included the step "wherein the computer is further programmed to determine dimensions of an FOV and, from the dimensions, determine a number of radial partitions such that discontinuities between adjacent k-space

locations are reduced" of Riederer in the elliptic centric phase order acquisition MR apparatus/system of Misretta in view of Ookawa further in view of Jezzard in order to determine the spacing between k-space views (radial partitions) required for each k-space acquisition as taught by Riederer.

5. Claim 19, is rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 5,873,825 to Misretta (Misretta) in view of Pub. No. US 2001/0004211 to Ookawa (Ookawa) further in view of Jezzard, Peter "Physical Basis of Spatial Distortions in Magnetic Resonance Images." in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435; hereinafter Jezzard (Jezzard), and further in view of US Pat. No. 6,380740 to Laub (Laub).

In Reference to Claim 19

Misretta in view of Ookawa further in view of Jezzard has been shown to teach all of the limitations of claim 11. However, Misretta in view of Ookawa further in view of Jezzard fails to explicitly teach the step "wherein the computer is programmed to partition k-space into partitions of similar size."

Laub teaches the partitioning of k-space into partitions of similar size (see Laub column 7, lines 7-26). Laub further teaches that the selection of the number and relative size of the segments may be varied and customized to the application at hand so as to enable sufficient spatial and temporal resolution for tracking dynamic (fast) events within the body (see Laub, column 7, lines 13-21).

Therefore, it would also have been obvious to one of ordinary skill in the art at the time of the invention to have included the step "wherein the computer is programmed to partition k-space into partitions of similar size" of Laub in the magnetization preparation scheme and MRI system of Misretta in view of Ookawa further in view of Jezzard in order to be able to obtain adequate and rapid spatial and temporal resolution for acquiring images using a rapid scanning technique.

(10) Response to Argument

Appellant's arguments filed December 9, 2008 have been fully considered, but they are not persuasive.

With respect to the 35 U.S.C. § 103(a) rejections to claims 1, 2, 4-6, 9, 10, and 20-25, appellant asserts that the tertiary reference to Jezzard is non-analogous (**see Appeal Brief, section 7, pages 3 and 4**) because "Jezzard simply addresses spatial distortions in **conventional** magnetic resonance imaging" while citing Jezzard, Sections 6.1 - 6.2, pp. 433-434. The Jezzard reference in section 6.2, discloses noise generation in images that result from the application of (MR) ***pulse sequences*** (normally in a specific/nonconventional "partially saturated state") leading to non-steady effects . Appellant's disclosure cites the intent of the proposed invention is to help to "greatly improve image quality with the reduction of ghosting artifacts typically associated with steady state effects" (**See Applicant Specification, Para. [0030]**). Additionally, appellant's disclosure cites "improving image quality" as well as facilitating image acquisition speed/throughput (**See Applicant Specification, Para. [0008].** These are

significant because in addition to reducing noise related artifacts (i.e. ***applicant's ghosting***) associated with MR pulse regimes that lead to non-steady state conditions (**Jezzard p.434, paragraph 1**), the Jezzard reference discloses attempting to optimize "image quality" and minimize "the duration of the scan itself" as conditions in (rapid) acquisition MR imaging that lead to non-steady state conditions requiring the application of dummy acquisitions for correction (**see Jezzard section 6.2, paragraphs 1, 2 and 4, pp. 433-434, and equations 11-13**). Therefore, Jezzard discloses all three conditions disclosed by appellant as objectives of the proposed invention, and, correspondingly is not limited to conventional MR, but would be applicable to any MR acquisition or (nonconventional) partial saturation state producing pulse sequences that necessitate correction of artifact or noise effects due to non-steady state conditions (as disclosed by Jezzard and discussed supra).Therefore, the reference is both analogous and properly motivated for application to the lacking elements of the primary references.

Appellant further asserts that Jezzard fails to disclose both "the use of magnetic preparation pulses prior to data acquisition" and "the elliptical centric phase ordered acquisition of Appellant's invention." The basis for these limitations was established through the Ookawa in view of Laub references as cited in the final office action (**see pp. 4-5, section 8**). Further, appellant's reference to Jezzard page 427 is not cited by Examiner as applicable to the claims in appellant's application, but rather pages 433-434 (**see advisory action, section 3 and office action, p. 6**) which has to do with pulse sequences and (fast) image acquisitions protocols that result in image noise and non-steady state effects. Noise and non-steady state conditions are the limitations

lacking when magnetic preparation pulses are combined with elliptic centric phase ordered acquisition (**see Applicant Specification, Para. [0007- 0008]**). This is the basis for applying the Jezzard reference as discussed supra.

Lastly, appellant argues that Jezzard, while disclosing the application of dummy acquisitions or scans (**Appeal Brief p.4, par. 2**), does not disclose "playing out a dummy acquisition following each of the magnetic preparation pulses" (**Appeal Brief p.6, par. 1, Re: claim 11**). Appellant further argues that the disclosure by Jezzard in no way teaches where (frequency), when and how (pattern) many dummy scans should be played out (**Appeal Brief p.4, par. 2, Re: claim 1**) and that “simply disclosing some benefit of playing out a ‘dummy scan’ is not tantamount to a teaching sufficient to teach one skilled in the art how to practice the invention as claimed.” (**Appeal Brief p.7, par. 2 Re: claim 20**).

However, the Jezzard reference does disclose that "[a] well-designed pulse sequence will incorporate enough 'dummy scan' acquisitions that when the image signal is detected, the spins have reached a steady state." (**Jezzard, Section 6.2, p. 434**), as acknowledged by Appellant (**see Appeal Brief p.4, par. 2**). Appellant further asserts that in the proposed invention " dummy acquisitions are played out following each magnetic preparation pulse so as to reduce ghosting artifacts associated with steady state effects. See Specification, Para. [0026, 0030]”. (**see Appeal Brief p.4, par. 2**). As discussed supra, Jezzard establishes applying dummy acquisitions in sufficient magnitude to restore steady state. It would be obvious to one of ordinary skill as a matter of common sense to apply the dummy scans to the degree necessary

(frequency) to mitigate/eradicate and prior to the conditions (pattern) that cause the non-steady state effects. Further, the determination of the frequency of dummy scans or acquisitions is tantamount to determining the “optimum value” of scans to apply and the determination of a results effective variable has been held to involve only routine skill in the art. (**In re Boesch, 617 F.2d 272, 205 USPQ 215 <CCPA 1980>**).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner’s answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Salieu M Abraham/

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